

MPEG Audio

Product Test

MPEG Audio Test Suite

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CHANGE HISTORY

<u>Date</u>	<u>Person</u>	<u>Version</u>	<u>Reason</u>
1997-10-13	Bernard van Steenbrugge	0.0.1	Original version
1998-01-22	Bernard van Steenbrugge	0.0.2	Updated version
2002 01-24	Gerard Smelt		changes due to reallocation of website

1. INTRODUCTION

1.1 Purpose

The MPEG Test Suite becomes the suite with test files (bitstreams), which can be used to verify Decoder implementations. Implementations in components, as well as in products. The Test Suite contains Legal and Illegal bitstreams.

1.2 Scope

This document has been realised within the framework of the MPEG Audio Technology Program.

1.3 Definitions and abbreviations

1.3.1 Definitions

AC-3	:	Dolby Audio Compression standard
DTS	:	Digital Theatre System
MPEG MC Compliant	:	Compliant with requirements, set for MPEG empowered
non_PCM	:	Audio sample(s), not formatted as PCM
Quad speed_I ² S	:	I ² S at the Quad speed

1.3.2 Abbreviations

API	:	Application Programmers Interface
ASA	:	Advanced Systems & Applications
CD-DA	:	CD Digital Audio
DSP	:	Digital Signal Processor
fs	:	sampling frequency
IEC	:	International Electrotechnical Commission
I ² C	:	Inter IC
I ² S	:	Inter IC Sound
L-PCM	:	Multi Channel Linear PCM
MPEG	:	Moving Picture Experts Group
PCM	:	Pulse Code Modulation.

1.4 Documents

- [DVD_Spec,96] *DVD Specifications for Read-only disc*
Part 3, Video Specifications
Toshiba
Version 1.0, August 1996.
- [IEC958] *Digital Audio Interface*
International Electrotechnical Commission
1995 CD 2
- [IEC1937] *interface for non-PCM encoded Audio bitstreams applying IEC958*
Bernard van Steenbrugge
CD, May 1997
- [MPEG1] *Coding of Moving Pictures and Associated Audio for Digital Storage*
Media up to about 1.5 Mbit/s - part 3: Audio
ISO/IEC 11172-3: 1993
- [MPEG2] *Generic Coding of Moving Pictures and Associated Audio -*
part 3: Audio
ISO/IEC 13818-3, second edition: 1997
- [MPEG_test] *results of Audio Conformance Test Using Technical Report Software*
ISO/IEC JTC1/SC29/WG11N1237
March 1996

The numbering of IEC documents has been changed. IEC958 became IEC60958 and IEC1937 became IEC61937.

2. GENERAL APPROACH

Testing MPEG Decoders or Products containing MPEG decoders asks for a different approach. Assuming that only validated components will be used in Products, product tests may focus on functional tests. Components have to be tested on robustness against errors. MPEG decoders within products will be tested within that system environment. Decoder components can be tested without restrictions from the system.

In other words: Component testing are comprehensive tests, using a dedicated environment. Product test are functional tests, testing the behaviour within that system.

2.1 Component tests

Component tests consists of Hardware tests, tests on robustness of the implementation and functional tests.

Hardware tests are tests on correctness of all the data-path, memory and logic on the component. These tests are, more or less, part of the normal development/production of the component, and will not be covered by the test suite.

Test on robustness are test, targeted to visit all the legal, unexpected or illegal input variables. The audio content of the stream is not an issue when testing robustness. Legal streams should be used to judge the audio quality.

Functional tests are targeted to visit all the legal values of all the fields in an MPEG stream. Clause 6 gives an overview of all the streams currently accessible on the MPEG ftp site: "<ftp://ftp.tnt.uni-hannover.de/>", in the directory "pub/MPEG/audio/...". Clause 4 gives an overview of all the streams accessible in the MPEG empowered directories.

For a 100% test coverage, streams are required for testing all the legal values of a field with all the legal values of the other fields. A 100% coverage is not feasible. The focus of testing is to alter the values of all fields, and to visit all addresses of the tables at least ones.

2.2 Product test

Product test are test within a fixed environment using an approved component. The goal for this test is to evaluate the Audio within that configuration. For this test it is sufficient to visit only a subset of all the variables, a subset valid for that application. This test suite will target of testing variables in the number of channels, down-mixes, and Audio quality. This requires streams, which functionally are a subset of the component tests, but with different Audio contents.

2.3 Directory structure

The MPEG Test Suite is accessible via the website: <http://www.licensing.Philips.com/>. Each directory contains a README file, which gives some insight about the bitstreams within that directory.

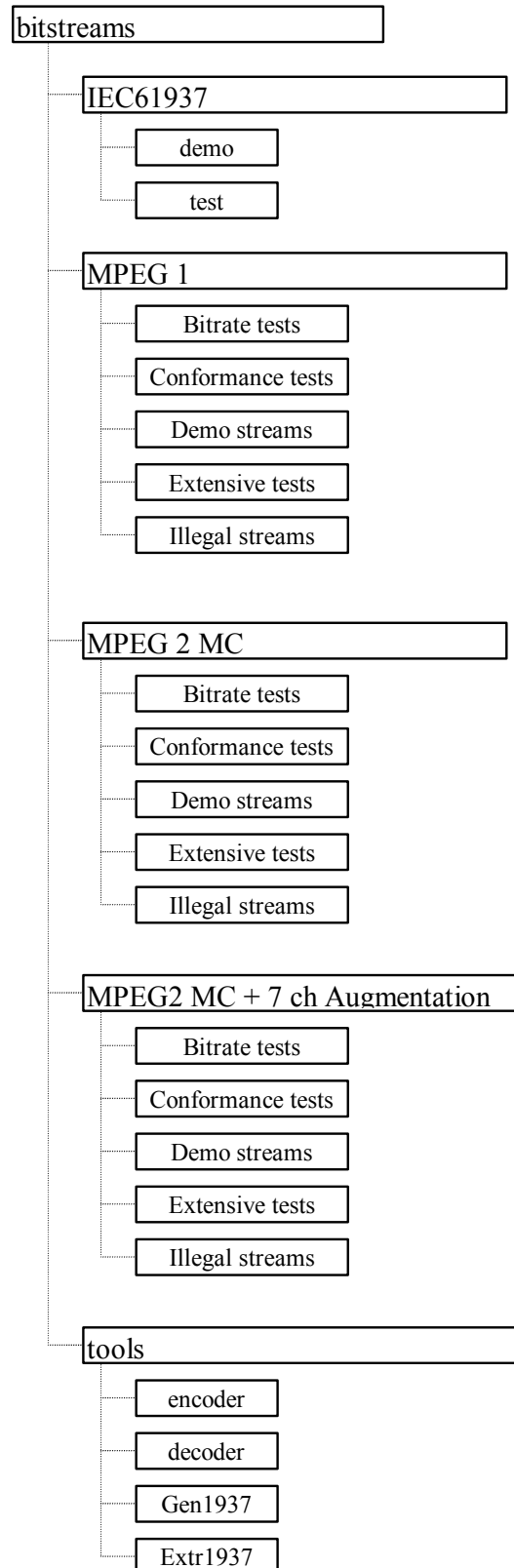


Figure 1 Directory structure of MPEG Test Suite

The directory 'IEC61937' contains test and demo bitstreams, formatted in IEC61937 format. The MPEG 1, MPEG 2 MC and MPEG 2 MC + 7 channel Augmentation directories contain

sub-directories with MPEG Base (*.mpg) and, when applicable, Extension streams (*.Ext.). The bitstreams in the sub-directories are targeted towards testing certain aspects:

The 'Bitrate test' is targeted to test the aspects regarding bitrates.

The 'Conformance streams' directory is specified in IEC/ISO 13818-4, the stream are accessible on the ftp site.

The 'demo' directory provides a couple of demo streams.

The 'Extensive test' directory contains streams, targeted to test all fields with all allowed values. This directory also contains streams to test the Bass Manager (sub-clause 4.4).

The 'Illegal stream' directory contains streams, in which fields are allocated with reserved or illegal values.

The Tools directory contains an encoder, a decoder, an IEC61937 formatter, and an Extractor of the IEC61937 format.

2.3.1 bitstreams for bitrate index testing, constant bitrate

streams: bridx_\$1_\$2_\$3 and bridx_\$1_\$2_\$3(_\$4)

\$1: the sampling frequency in kHz

\$2: the channel configuration being:

- 10 mono
- 11 dual channel
- 20 stereo
- 32 5.1 channels (L, R, C, LFE, LS, RS)
- 52 7.1 channels (L, R, C, LFE, LS, RS, LC, RC)

\$3: the MPEG 1 bitrate

- mono: 032, 048, 056, 064, 080, 096, 112, 128, 160 or 192 kbps
- others: 064, 096, 112, 128, 160, 192, 224, 256, 320 or 384 kbps

\$4: the total bitrate, only available for the 32 and 52 modes.

- 32 mode: 448 kbps
- 52 mode: 512 kbps

2.3.2 bitstreams for bitrate index testing, variable bitrate

streams: bridx_\$1_\$2_vbr

\$1: the sampling frequency in kHz

\$2: the channel configuration being:

- 10 mono
- 11 dual channel
- 20 stereo
- 32 5.1 channels (L, R, C, LFE, LS, RS)
- 52 7.1 channels (L, R, C, LFE, LS, RS, LC, RC)

2.3.3 demonstration bitstreams, constant bitrate

streams: demo_\$1_\$2_\$3

\$1: the sampling frequency in kHz

\$2: the channel configuration being:

- 10 mono
- 11 dual channel
- 20 stereo
- 32 5.1 channels (L, R, C, LFE, LS, RS)
- 52 7.1 channels (L, R, C, LFE, LS, RS, LC, RC)

\$3: the total bitrate

2.3.4 demonstration bitstreams, variable bitrate

streams: demo_\$1_\$2_vbr

\$1: the sampling frequency in kHz

\$2: the channel configuration being:

- 10 mono
- 11 dual channel
- 20 stereo
- 32 5.1 channels (L, R, C, LFE, LS, RS)
- 52 7.1 channels (L, R, C, LFE, LS, RS, LC, RC)

The Test directories also contain streams with bit faults, fields errors and allocation errors (illegal).

The Tool 'Gen1937' generates a IEC61937 formatted stream out of a MPEG Base (*.mpg), with, or without extension (*.ext.) stream in AIFF-C format. The Tool 'Extr1937' extracts the *.mpg and *.ext. streams out of an IEC1937 formatted stream.

3. COMPONENT TESTING

3.1 Purpose

The input for a decoder may be contain all variables specified in the MPEG Standard. In addition, input stream may be corrupt, the stream may contain bit faults. The Decoder must be able to retrieve the Audio samples out of the stream, and must be able to conceal the errors.

The test bench contains all sorts of streams to cover the full functionality and to evaluate the robustness of the component against errors.

3.2 Approach

3.3 Sections of MPEG bitstreams

The values, as listed for MPEG empowered are a subset of the Legal MPEG values. The column Legal lists the values, valid according to MPEG, but not supported by MPEG empowered. Note that bit-errors in the header are not protected with any CRC. Tests with protection-off are useful by checking bit faults in the allocation, but is not covered by MPEG empowered.

3.3.1 MPEG 1 test cases

3.3.1.1 header

	MPEG empowered	MPEG	Illegal
Sync word	fff		<> fff
ID	1 = MPEG 1	0 = MPEG2 Low Fs	
Layer	10	11, 01	00
Protection	0	1	
bitrate index	0001.. 1110	0000	1111
Sampling Frequency	01, 00, 10		11
Padding	1; when fs = 44.1		test wrong length
	0, matching		
private bit	0	1	
mode	00, 01, 10, 11		fault 00 or 01 <-> 11
mode extension	00 .. 11		test bit fault
copyright	0, 1, I/O		
copy/original	0, 1, I/O		
emphasis	00	01, 11, I/O	10

Note: The sampling frequency for DVD is 48 kHz, the sampling frequency for video-CD is 44.1 kHz.

Note: Padding bit 1 means Length Base frame = $\text{bitrate} / \text{fs} * 1152 (\text{LII}) + 8$ bits

0 means Length Base frame = $\text{bitrate} / \text{fs} * 1152 (\text{LII})$.

Note: The padding bit is always set to '0' in case fs = 48 kHz, fs = 32 kHz, or fs = 44.1 kHz and variable bitrate.

3.3.1.2 CRC

		MPEG	Illegal
	MPEG empowered		
CRC	16 bit	0 bit	false CRC

MPEG empowered bitstreams, DVD streams inclusive, always utilise the CRC protection.
 If (Protection == 0) then length_of_CRC_field is 16 bits, and contains the CRC over the header, allocation and scfsi. If (Protection == 1) then length_of_CRC_field is 0 bits, and the bitstream is not protected against errors.

3.3.1.3 Side info

		MPEG	Illegal
	MPEG empowered		
allocation	until sblimit		
scfsi	until sblimit		
scalefactors	until sblimit		value 63

3.3.1.4 Audio

		MPEG	Illegal
	MPEG empowered		
Sample words	all valid values		illegal values

In case no grouping applies sample words with all '1's are illegal, otherwise
 in case the number of levels is 3 sample words with values 0x1B .. 0x1F are illegal,
 in case the number of levels is 5 sample words with values 0x7D .. 0x7F are illegal,
 in case the number of levels is 9 sample words with values 0x2D9 .. 0x2FF are illegal,

3.3.1.5 Bass Manager test streames

The Bass manager test streams contain a logarithmic sweep from 20 Hz to 20 kHz. The length of these streams is 10 seconds.

3.3.2 MPEG 2 MC

		MPEG	Illegal
	MPEG empowered		
MC header	Within Base frame		not within Base frame

3.3.2.1 MC-header

		MPEG	Illegal
	MPEG empowered		
Ext.Stream present	0 or 1		
n-ad-bytes	0 .. 63	64 .. 255	
Centre	00, 01, 11		10
surround	00 .. 11		
lfe	0, 1		
audio-mix	0 or 1 I/O		
dematrix	00 .. 10, 11		
nr_of_ML	000	001 .. 111	
ML_fs		0 or 1	
ML Layer		0 or 1	
copy_ident_bit	0 or 1; I/O		
copy_ident_start	0 or 1; I/O		

The MC-header must be encoded within the MPEG Base frame.

Ext.Stream present 0 true, no extension
 1 with extension.

Base frame - (Ancillary data + 16 (+8)) bits MC-header < 0

Note: MPEG allows up to 255 Bytes of ancillary data in the MPEG Base frame, in case the Base frame is accompanied by an extension. There is no limit in case there is no extension. But any MPEG empowered decoder should be able to store at least 64 ancillary data bytes. The ancillary data will be overwritten by the ancillary data of a next frame. The implementation should provide double buffering in order to avoid that data will be lost.

3.3.2.2 CRC

	MPEG	Illegal
	MPEG empowered	
CRC	16 bit	false CRC

The length_of_CRC_field is 16 bits, and contains the CRC over the header, allocation and scfsi.

3.3.2.3 MC Composite Status info

	MPEG	Illegal
	MPEG empowered	
tc_sbgr_select	0 or 1	swap
Dyn_cross_on	0 or 1	swap
MC_Pred_on	0	swap
tc_allocation	0 .. 7	mtx = 3 + tca <> 0
tc_allocation[sbgr]		PC + 3/2; tca<> 0,3,4,5
		PC + 3/1; tca<> 0,3,4
		PC + 3/0; tca<> 0
		1/0 (+2.0) + tca <> 0
dyn_cross_LR	0 or 1	'1' + MPEG 1 single
dyn_cross_mode[sbgr]	0 .. f	conflicts
dyn_2nd_stereo[sbgr]	0 or 1	<> 3+2 or 2 + 2
mc_prediction[sbgr]	0, 1	
predsi[sbgr][px]	00 .. 11	

bit streams with matrix mode 3 and tca <> 0, and with an illegal tc_allocation, are bit streams with a valid syntax, but with invalid semantics.

3.3.2.4 MC Side info

	MPEG	Illegal
	MPEG empowered	
allocation	until sblimit	
scfsi	until sblimit	
delay-comp[sbgr][px]		insert '0's
pred_coeff[sbgr][px][pci]		insert '0's
scalefactors	until sblimit	value 63

3.3.2.5 MC Audio

	MPEG	Illegal
	MPEG empowered	
Sample words	all valid values	illegal values

In case no grouping applies sample words with all '1's are illegal, otherwise
 in case the number of levels is 3 sample words with values 0x1B .. 0x1F are illegal,
 in case the number of levels is 5 sample words with values 0x7D .. 0x7F are illegal,
 in case the number of levels is 9 sample words with values 0x2D9 .. 0x2FF are illegal,

3.3.2.6 Bass Manager test streames

The Bass manager test streams contain a logarithmic sweep from 20 Hz to 20 kHz (LFE: 20 Hz to 120 Hz). The length of these streams is 10 seconds.

3.3.2.7 Multi Lingual

Multi Lingual is not supported within MPEG empowered. No bits should be inserted, and may be tested by toggling the bits in the MC-header.

3.3.2.8 Extension

	MPEG	Illegal
	MPEG empowered	
Extension header	Empty stream	no header
Ext. Sync.	0x7ff	<> 0x7ff
Ext. CRC	test length < 128 bits	wrong CRC
Ext. Length	fs = 48 5 .. 1584 0 .. 4 or 1585 .. 2047	
	fs = 44.1 5 .. 1724 0 .. 4 or 1725 .. 2047	
	fs = 32 5 .. 2047 0 .. 4	
Ext. ID	0	1
Ext. data	all	

The length_of_CRC_field is 16 bits, and contains the CRC over the first 128 bits.

Note: The maximum bitrate for MPEG Multi Channel is 912 kbps. Due to the bitrate of MPEG-1 with fs = 44.1 kHz, it is not possible to create a stream of 912 kbps constant bitrate with fs = 44.1 kHz.

3.3.3 7 channel Augmentation

	MPEG	Illegal
	MPEG empowered	
sev_info		
aug_mtx_proc	00, 01, 11	10
aug_DynX_on	0 or 1	
aug_future_ext	0	1
tca7	all	
DynX_mode7	0 .. 18	19 .. 31
sev_error_check	true CRC	false CRC
Side Info		
allocation	until sblimit	
scfsi	until sblimit	
scalefactors	until sblimit	value 63
data		
Sample words	all valid values	illegal values

The length_of_CRC_field is 16 bits, the sev_error_check contains the CRC over the sev_info, sev_side_info, allocation and scfsi.

In case no grouping applies sample words with all '1's are illegal, otherwise
 in case the number of levels is 3 sample words with values 0x1B .. 0x1F are illegal,
 in case the number of levels is 5 sample words with values 0x7D .. 0x7F are illegal,
 in case the number of levels is 9 sample words with values 0x2D9 .. 0x2FF are illegal.

3.3.3.1 Bass Manager test streames

The Bass manager test streams contain a logarithmic sweep from 20 Hz to 20 kHz (LFE: 20 Hz to 120 Hz). The length of these streams is 10 seconds.

3.3.4 latency

Streams with test signals, targeted to measure latency. This can be done with bitstream, containing a signal, which repeats every frame, and contains a maximum or tonal component in the first sample of that frame.

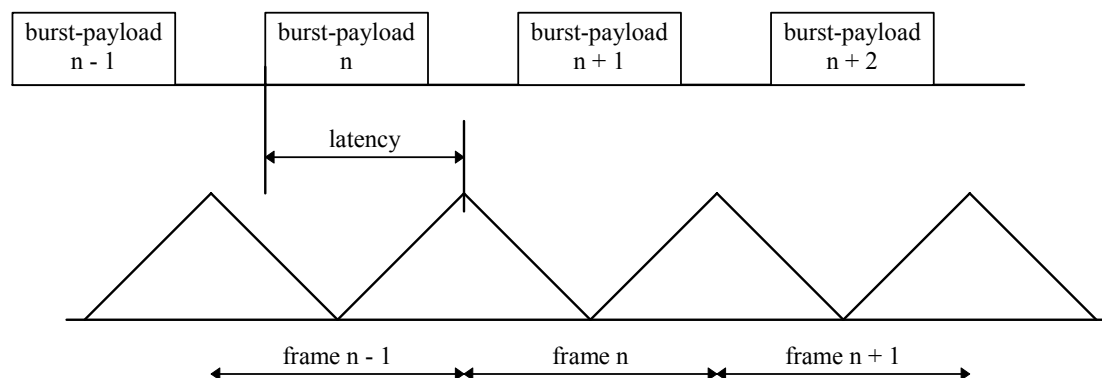


Figure 2 Example of Latency with known Audio contents

Note: specify the tolerance of the Latency.

3.3.5 IEC61937

3.3.5.1 Test Preambles

		Legal	Illegal
Pa = 0xF872			
Pb = 0x4E1F			
Pc	bit 0.. 4	Pause = 3 without Extension = 5 with Extension = 6	0, 1, 2, 4, 7 .. 31
Pc	bit 5, 6	00	01, 10, 11
Pc	bit 7	0 or 1	
Pc	bit 8	0 or 1	
Pc	bit 9	0 or 1	
Pc	bit 10 .. 12	000	001 .. 111
Pc	bit 13 .. 15	000	001 .. 111
Pb		Length of Payload	<> Length of Payload

Note: Illegal combinations of Pc are all reserved.

3.3.5.2 Payload

	valid burst-payload	Illegal
burst with data type 3		
burst with data type 5	MPEG layer II without Extension	other payload

burst with data type 6 MPEG layer II with extension other payload

The length of the Payload of Pause bursts Pd is 0x20. The content of the Payload is most likely 0x0000, but may have any value (length of gap), except for 0x0001 and 0x0002.

3.3.5.3 Test repetition period

The repetition period of bursts with data-type 5 or 6 is 1152 sampling periods +/- n sampling periods. The repetition period of Pause bursts is 32 sampling periods, and is applied in multiples of 3.

4. MPEG EMPOWERED TEST STREAMS

MPEG2 Multi-channel, DVD v1.0 specific, test streams definition

Naming convention: 32023n10 stands for

3 = 3 front channels
 2 = 2 rear channels
 0 = 2nd stereo
 2 = the value of tca
 3 = the value of dynx
 n = no phantom coding
 1 = dynx L/R
 0 = matrix mode MPEG2

4.1 MPEG2 Multi channel test streams

The streams specified in this clause can be found in the directory 'MPEG2/extensive-tests'

Table 1 3/2 mode, Dynamic Crosstalk testing

	Centre	Surround	tca	dynx	dynx L/R	dynx_2nd	mtx
32000n00	1	2	0	0	0	0	0
32004n00	1	2	0	4	0	0	0
32004n10	1	2	0	4	1	0	0
32008n00	1	2	0	8	0	0	0
32009n00	1	2	0	9	0	0	0
3200An00	1	2	0	10	0	0	0
32003n00	1	2	0	3	0	0	0
32003n10	1	2	0	3	1	0	0
32013n00	1	2	1	3	0	0	0
32013n10	1	2	1	3	1	0	0
32023n00	1	2	2	3	0	0	0
32023n10	1	2	2	3	1	0	0

Table 2 3/2 mode, TCA testing

	Centre	Surround	tca	dynx	dynx L/R	dynx_2nd	mtx
32010n00	1	2	1	0	0	0	0
32020n00	1	2	2	0	0	0	0
32030n00	1	2	3	0	0	0	0
32040n00	1	2	4	0	0	0	0
32050n00	1	2	5	0	0	0	0
32060n00	1	2	6	0	0	0	0
32070n00	1	2	7	0	0	0	0
32000n01	1	2	0	0	0	0	1
32010n02	1	2	1	0	0	0	2
32020n02	1	2	2	0	0	0	2
32030n02	1	2	3	0	0	0	2
32040n02	1	2	4	0	0	0	2
32050n02	1	2	5	0	0	0	2
32060n02	1	2	6	0	0	0	2
32070n02	1	2	7	0	0	0	2
32000n03	1	2	0	0	0	0	3

Table 3 3/2 mode, Phantom Centre testing

	Centre	Surround	tca	dynx	dynx L/R	dynx_2nd	mtx
32000y00	3	2	0	0	0	0	0
32003y00	3	2	0	3	0	0	0
32040y00	3	2	4	0	0	0	0

Table 4 3/1 mode, Dynamic Crosstalk testing

	Centre	Surround	tca	dynx	dynx L/R	dynx_2nd	mtx
31000n00	1	1	0	0	0	0	0
31004n00	1	1	0	4	0	0	0
31004n10	1	1	0	4	1	0	0
31003n00	1	1	0	3	0	0	0
31003n10	1	1	0	3	1	0	0
31013n00	1	1	1	3	0	0	0
31013n10	1	1	1	3	1	0	0
31023n00	1	1	2	3	0	0	0
31023n10	1	1	2	3	1	0	0

Table 5 3/1 mode, TCA testing

	Centre	Surround	tca	dynx	dynx L/R	dynx_2nd	mtx
31010n00	1	1	1	0	0	0	0
31020n00	1	1	2	0	0	0	0
31030n00	1	1	3	0	0	0	0
31040n00	1	1	4	0	0	0	0
31000n01	1	1	0	0	0	0	1
31010n02	1	1	1	0	0	0	2
31020n02	1	1	2	0	0	0	2
31030n02	1	1	3	0	0	0	2
31040n02	1	1	4	0	0	0	2
31050n02	1	1	5	0	0	0	2
31000n03	1	1	0	0	0	0	3

Table 6 3/1 mode, Phantom Centre testing

	Centre	Surround	tca	dynx	dynx L/R	dynx_2nd	mtx
31000y00	3	1	0	0	0	0	0
31002y00	3	1	0	2	0	0	0
31040y00	3	1	4	0	0	0	0

Table 7 3/0 mode, Dynamic Crosstalk testing

	Centre	Surround	tca	dynx	dynx L/R	dynx_2nd	mtx
30000n00	1	0	0	0	0	0	0
30001n00	1	0	0	1	0	0	0
30001n10	1	0	0	1	1	0	0
30011n00	1	0	1	1	0	0	0
30011n10	1	0	1	1	1	0	0
30021n00	1	0	2	1	0	0	0
30021n10	1	0	2	1	1	0	0

Table 8 3/0 mode, TCA testing

	Centre	Surround	tca	dynx	dynx L/R	dynx_2nd	mtx
30010n00	1	0	1	0	0	0	0
30020n00	1	0	2	0	0	0	0
30000n01	1	0	0	0	0	0	1
30000n03	1	0	0	0	0	0	3

Table 9 3/0 mode, Phantom Centre testing

	Centre	Surround	tca	dynx	dynx L/R	dynx_2nd	mtx
30000y00	3	0	0	0	0	0	0
30001y00	3	0	0	1	0	0	0

Table 10 3/0 + 2/0 mode, Dynamic Crosstalk testing

	Centre	Surround	tca	dynx	dynx L/R	dynx_2nd	mtx
30200n00	1	3	0	0	0	0	0
30201n00	1	3	0	1	0	0	0
30201n10	1	3	0	1	1	1	0
30211n00	1	3	1	1	0	0	0
30211n10	1	3	1	1	1	1	0
30221n00	1	3	2	1	0	0	0
30221n10	1	3	2	1	1	1	0

Table 11 3/0 + 2/0 mode, TCA testing

	Centre	Surround	tca	dynx	dynx L/R	dynx_2nd	mtx
30210n00	1	3	1	0	0	0	0
30220n00	1	3	2	0	0	0	0
30200n01	1	3	0	0	0	0	1
30201n11	1	3	0	1	1	1	1
30200n03	1	3	0	0	0	0	3
30201n13	1	3	0	1	1	1	3

Table 12 3/0 + 2/0 mode, Phantom Centre testing

	Centre	Surround	tca	dynx	dynx L/R	dynx_2nd	mtx
30200y00	3	3	0	0	0	0	0
30201y10	3	3	0	1	1	1	0

Table 13 2/2 mode, Dynamic Crosstalk testing

	Centre	Surround	tca	dynx	dynx L/R	dynx_2nd	mtx
22000n00	0	2	0	0	0	0	0
22004n00	0	2	0	4	0	0	0
22003n00	0	2	0	3	0	0	0
22003n10	0	2	0	3	1	0	0
22033n00	0	2	3	3	0	0	0
22033n10	0	2	3	3	1	0	0

Table 14 2/2 mode, TCA testing

	Centre	Surround	tca	dynx	dynx L/R	dynx_2nd	mtx
22010n00	0	2	1	0	0	0	0
22020n00	0	2	2	0	0	0	0
22030n00	0	2	3	0	0	0	0
22000n01	0	2	0	0	0	0	1
22000n03	0	2	0	0	0	0	3

Table 15 2/1 mode, Dynamic Crosstalk testing

	Centre	Surround	tca	dynx	dynx L/R	dynx_2nd	mtx
21000n00	0	1	0	0	0	0	0
21001n00	0	1	0	1	0	0	0
21001n10	0	1	0	1	1	0	0
21011n00	0	1	1	1	0	0	0
21011n10	0	1	1	1	1	0	0
21021n00	0	1	2	1	0	0	0
21021n10	0	1	2	1	1	0	0

Table 16 2/1 mode, TCA testing

	Centre	Surround	tca	dynx	dynx L/R	dynx_2nd	mtx
21010n00	0	1	1	0	0	0	0
21020n00	0	1	2	0	0	0	0
21000n01	0	1	0	0	0	0	1
21000n03	0	1	0	0	0	0	3

Table 17 2/0 + 2/0 mode, Dynamic Crosstalk testing

	Centre	Surround	tca	dynx	dynx L/R	dynx_2nd	mtx
20200n00	0	3	0	0	0	0	0
20200n10	0	3	0	0	1	1	0

Remarks:

- LFE is not present in this set of test streams
- 1/0 + 2/0 streams are not present
- Bitrate 384 kbps, no extension stream used
- dematrix procedure 2 is reserved to the configurations 3/2 and 3/1

4.2 MPEG2 Multi channel, DVD v1.0 specific, additional test streams.

The streams specified in this clause can be found in the directory 'MPEG2/extensive-tests'

Table 18 3/2 modes

	Centre	Surround	LFE	tca	dynx	dynx L/R	dynx 2nd	mtx	ext
320R0n00	1	2	0	R	0	0	0	0	yes
320RRn01	1	2	1	R	R	0	0	1	no
320RRyR2	3	2	0	R	R	R	0	2	yes
320R0y00	3	2	1	R	0	0	0	0	no

Table 19 3/1 modes

	Centre	Surround	LFE	tca	dynx	dynx L/R	dynx 2nd	mtx	ext
310R0n01	1	1	0	R	0	0	0	1	yes
310RRn02	1	1	1	R	R	0	0	2	no
310RRyR0	3	1	0	R	R	R	0	0	yes
310R0y01	3	1	1	R	0	0	0	1	no

Table 20 3/0 modes

	Centre	Surround	LFE	tca	dynx	dynx L/R	dynx 2nd	mtx	ext.
300R0n01	1	0	0	R	0	0	0	1	yes
300RRnR0	1	0	1	R	R	R	0	0	no
3000Ry01	3	0	0	0	R	0	0	1	yes
30000y01	3	0	1	0	0	0	0	1	no

Table 21 3/0 + 2/0 modes

	Centre	Surround	LFE	tca	dynx	dynx L/R	dynx 2nd	mtx	ext.
302R0n00	1	3	0	R	0	0	0	0	yes
302RRn01	1	3	1	R	R	0	0	1	no
302R0nR0	1	3	0	R	0	R	R	0	yes
30200y01	3	3	1	0	0	0	0	1	no
3020Ry00	3	3	0	0	R	0	0	0	yes
30200yR1	3	3	1	0	0	R	R	1	no

Table 22 2/2 modes

	Centre	Surround	LFE	tca	dynx	dynx L/R	dynx 2nd	mtx	ext.
220R0n00	0	2	0	R	0	0	0	0	yes
220RRn01	0	2	1	R	R	0	0	1	no

Table 23 2/1 modes

	Centre	Surround	LFE	tca	dynx	dynx L/R	dynx 2nd	mtx	ext.
--	--------	----------	-----	-----	------	----------	----------	-----	------

210R0n00	0	1	0	R	0	0	0	0	yes
210RRn01	0	1	1	R	R	0	0	1	no

Table 24 2/0 + 2/0 modes

	Centre	Surround	LFE	tca	dynx	dynx L/R	dynx 2nd	mtx	ext.
20200n01	0	3	0	0	0	0	0	1	yes
20200nR1	0	3	1	0	0	R	R	1	no

Table 25 1/0 + 2/0 modes

	Centre	Surround	LFE	tca	dynx	dynx L/R	dynx 2nd	mtx	ext.
10200n00	0	3	0	0	0	0	0	0	yes
10200nR1	0	3	1	0	0	R	R	1	no

Table 26 2/0 modes

	Centre	Surround	LFE	tca	dynx	dynx L/R	dynx 2nd	mtx	ext.
20000n00	0	0	0	0	0	0	0	0	yes
20000n01	0	0	1	0	0	0	0	1	no

Table 27 1/0 modes

	Centre	Surround	LFE	tca	dynx	dynx L/R	dynx 2nd	mtx	ext.
10000n00	0	0	0	0	0	0	0	0	no

Remarks:

- Value 'R' means a random but allowed value is used
- dematrix procedure 2 is reserved to the configurations 3/2 and 3/1
- Value 3 for Centre stands for Phantom Coding
- .- Value 3 for Surround means 2nd Stereo.

MPEG2 Multi channel, DVD v1.0 specific, variable bit rate test streams definition

- 6t_vbr: a 3/2.1 stream, MPEG2 Audio
- TA04: a 3/2.0 stream, average bit rate about 214 kbps.
- TA05: a 3/2.0 stream, average bit rate about 601 kbps.
- TA06: a 3/2.1 stream, average bit rate about 257 kbps.
- TA07: a 3/2.1 stream, average bit rate about 605 kbps.

The bitstream 'MPEG2_extreme' is a MPEG 2 stream, asking maximum performance from a MPEG empowered decoder

4.3 MPEG2 7.1-channel augmentation test streams definition

The streams specified in this clause can be found in the directory 'MPEG2_7ch/extensive-tests'

Table 28 TCA7 for augmentation matrix mode 0

	LFE	tca5	dynx5	mtx5	tca7	dynx 7	mtx7	ext.
52000000	0	0	0	0	0	0	0	yes
52000100	0	0	0	0	1	0	0	yes
52000200	0	0	0	0	2	0	0	yes
52000300	0	0	0	0	3	0	0	yes
52000400	0	0	0	0	4	0	0	yes
52000500	0	0	0	0	5	0	0	yes
52000600	0	0	0	0	6	0	0	yes
52000700	0	0	0	0	7	0	0	yes

Table 29 TCA7 for augmentation matrix mode 1

	LFE	tca5	dynx5	mtx5	tca7	dynx 7	mtx7	ext.
52000001	0	0	0	0	0	0	1	yes
52000101	0	0	0	0	1	0	1	yes
52000201	0	0	0	0	2	0	1	yes
52000301	0	0	0	0	3	0	1	yes

Table 30 TCA7 for augmentation matrix mode 3

	LFE	tca5	dynx5	mtx5	tca7	dynx 7	mtx7	ext.
52000003	0	0	0	0	0	0	3	yes

Table 31 Augmentation Dynamic Cross modes

	LFE	tca5	dynx5	mtx5	tca7	dynx 7	mtx7	ext.
52000000	0	0	0	0	0	0	0	yes
52000010	0	0	0	0	0	1	0	yes
52000020	0	0	0	0	0	2	0	yes
52000030	0	0	0	0	0	3	0	yes
52000040	0	0	0	0	0	4	0	yes
52000050	0	0	0	0	0	5	0	yes
52000060	0	0	0	0	0	6	0	yes
52000070	0	0	0	0	0	7	0	yes
52000080	0	0	0	0	0	8	0	yes
52000090	0	0	0	0	0	9	0	yes
520000A0	0	0	0	0	0	10	0	yes
520000B0	0	0	0	0	0	11	0	yes
520000C0	0	0	0	0	0	12	0	yes
520000D0	0	0	0	0	0	13	0	yes
520000E0	0	0	0	0	0	14	0	yes
520000F0	0	0	0	0	0	15	0	yes
520000G0	0	0	0	0	0	16	0	yes
520000H0	0	0	0	0	0	17	0	yes
520000I0	0	0	0	0	0	18	0	yes

Table 32 Running modes

	LFE	tca5	dynx5	mtx5	tca7	dynx 7	mtx7	ext.
52000R00	0	0	0	0	R	0	0	yes
52000R01	0	0	0	0	R	0	1	yes
520000R0	0	0	0	0	0	R	0	yes
520000R1	0	0	0	0	0	R	1	yes
5200000R	0	0	0	0	0	0	R	yes
52000RR0	0	0	0	0	R	R	0	yes
52000RR1	0	0	0	0	R	R	1	yes
52000RRR	0	0	0	0	R	R	R	yes
520R00R0	0	0	R	0	0	R	0	yes
520R0RR0	0	0	R	0	R	R	0	yes
52RR00R0	0	R	R	0	0	R	0	yes
52RR0RR0	0	R	R	0	R	R	0	yes
52RR1RR0	0	R	R	1	0	R	0	yes
52RR2RR0	0	R	R	2	0	R	0	yes
52RR3RR0	0	R	R	3	0	R	0	yes
52RRRRR0	0	R	R	R	0	R	0	yes
52RRRRR1	0	R	R	R	0	R	1	yes
52RRRRR3	0	R	R	R	0	R	3	yes
52RRRRRR	0	R	R	R	0	R	R	yes

Remarks:

- Value 'R' means a random but allowed value is used

MPEG2 7.1-channel augmentation variable bit rate test streams definition

- 8t_vbr: a 5/2.1 stream, MPEG2 Audio with 7.1-channel augmentation
- TA08: a 5/2.1 stream, average bit rate about 568 kbps.
- TA09: a 5/2.1 stream, average bit rate about 856 kbps.
- TA10: a 5/2.1 stream, average bit rate about 712 kbps.
- TA11: a 5/2.1 stream, average bit rate about 459 kbps.
- TA12: a 5/2.1 stream, average bit rate about 876 kbps.
- 8ch_id32: a 32 kHz 5/2.1 8 channel identification stream
- 8ch_id44: a 44 kHz 5/2.1 8 channel identification stream
- 8ch_id48: a 48 kHz 5/2.1 8 channel identification stream

The bitstream 'MPEG2_7ch_extreme' is a MPEG 2 stream with 7.1-ch aug, asking maximum performance from a MPEG empowered decoder

4.4 Bass Manager test streams

4.4.1 mpeg1:

The streams specified in this clause can be found in the directory 'MPEG1/extensive-tests'

- swp_1ch_CC: Log sweep at -20 dBFS in single channel
- swp_2ch_LL: Log sweep at -20 dBFS in left channel
- swp_2ch_RR: Log sweep at -20 dBFS in right channel
- swp_2ch_XX: Log sweep at -20 dBFS in both channels

- sin_1ch_0dB: 30 Hz sine at 0 dBFS in single channel
- sin_1ch_3dB: 30 Hz sine at -3 dBFS in single channel
- sin_2ch_0dB: 30 Hz sine at 0 dBFS in both channels
- sin_2ch_3dB: 30 Hz sine at -3 dBFS in both channels

4.4.2 mpeg2:

The streams specified in this clause can be found in the directory 'MPEG2/extensive-tests'

- swp_6ch_M0_LL: Log sweep at -20 dBFS in left channel, dematrix_proc=0
- swp_6ch_M0_RR: Log sweep at -20 dBFS in right channel, dematrix_proc=0
- swp_6ch_M0_CC: Log sweep at -20 dBFS in center channel, dematrix_proc=0
- swp_6ch_M0_LF: Log sweep at -20 dBFS in LFE channel, dematrix_proc=0
- swp_6ch_M0_LS: Log sweep at -20 dBFS in left surround channel, dematrix_proc=0
- swp_6ch_M0_RS: Log sweep at -20 dBFS in right surround channel, dematrix_proc=0
- swp_6ch_M0_XX: Log sweep at -20 dBFS in all channels, dematrix_proc=0
- swp_6ch_M2_LL: Log sweep at -20 dBFS in left channel, dematrix_proc=2
- swp_6ch_M2_RR: Log sweep at -20 dBFS in right channel, dematrix_proc=2
- swp_6ch_M2_CC: Log sweep at -20 dBFS in center channel, dematrix_proc=2
- swp_6ch_M2_LF: Log sweep at -20 dBFS in LFE channel, dematrix_proc=2
- swp_6ch_M2_LS: Log sweep at -20 dBFS in left surround channel, dematrix_proc=2
- swp_6ch_M2_RS: Log sweep at -20 dBFS in right surround channel, dematrix_proc=2
- swp_6ch_M2_XX: Log sweep at -20 dBFS in all channels, dematrix_proc=2
- sin_6ch_M0_0dB: 30 Hz sine at 0 dBFS in all channels, dematrix_proc=0
- sin_6ch_M0_3dB: 30 Hz sine at -3 dBFS in all channels, dematrix_proc=0
- sin_6ch_M2_0dB: 30 Hz sine at 0 dBFS in all channels, dematrix_proc=2
- sin_6ch_M2_3dB: 30 Hz sine at -3 dBFS in all channels, dematrix_proc=2

4.4.3 mpeg2_7ch:

The streams specified in this clause can be found in the directory 'MPEG2_7ch/extensive-tests'

- swp_8ch_M0_LL: Log sweep at -20 dBFS in left channel, dematrix_proc=0
- swp_8ch_M0_RR: Log sweep at -20 dBFS in right channel, dematrix_proc=0
- swp_8ch_M0_CC: Log sweep at -20 dBFS in center channel, dematrix_proc=0
- swp_8ch_M0_LF: Log sweep at -20 dBFS in LFE channel, dematrix_proc=0
- swp_8ch_M0_LS: Log sweep at -20 dBFS in left surround channel, dematrix_proc=0
- swp_8ch_M0_RS: Log sweep at -20 dBFS in right surround channel, dematrix_proc=0
- swp_8ch_M0_LC: Log sweep at -20 dBFS in left center channel, dematrix_proc=0
- swp_8ch_M0_RC: Log sweep at -20 dBFS in right center channel, dematrix_proc=0
- swp_8ch_M0_XX: Log sweep at -20 dBFS in all channels, dematrix_proc=0
- swp_8ch_M2_LL: Log sweep at -20 dBFS in left channel, dematrix_proc=2
- swp_8ch_M2_RR: Log sweep at -20 dBFS in right channel, dematrix_proc=2

- swp_8ch_M2_CC: Log sweep at -20 dBFS in center channel, dematrix_proc=2
- swp_8ch_M2_LF: Log sweep at -20 dBFS in LFE channel, dematrix_proc=2
- swp_8ch_M2_LS: Log sweep at -20 dBFS in left surround channel, dematrix_proc=2
- swp_8ch_M2_RS: Log sweep at -20 dBFS in right surround channel, dematrix_proc=2
- swp_8ch_M2_LC: Log sweep at -20 dBFS in left center channel, dematrix_proc=2
- swp_8ch_M2_RC: Log sweep at -20 dBFS in right center channel, dematrix_proc=2
- swp_8ch_M2_XX: Log sweep at -20 dBFS in all channels, dematrix_proc=2

- sin_8ch_M0_0dB: 30 Hz sine at 0 dBFS in all channels, dematrix_proc=0
- sin_8ch_M0_3dB: 30 Hz sine at -3 dBFS in all channels, dematrix_proc=0
- sin_8ch_M2_0dB: 30 Hz sine at 0 dBFS in all channels, dematrix_proc=2
- sin_8ch_M2_3dB: 30 Hz sine at -3 dBFS in all channels, dematrix_proc=2

4.5 Length tests

Padding bit = 1: Length Base frame = $\text{bitrate} / \text{fs} * 1152 \text{ (LII)} + 8 \text{ bits}$
 = 0: Length Base frame = $\text{bitrate} / \text{fs} * 1152 \text{ (LII)}$

Base frames with 0, 1, 2, 3 and 4 ancillary data bytes

Length extension = 0, 5, .., 1584 bytes

The streams specified in this clause can be found in the directories with illegal streams

5. LEGAL TEST STREAMS

The streams specified in this clause can be found in the directories 'demo', 'bitrate-tests' and 'extensive-tests'

5.1.1.1 header

	MPEG empowered
Layer	11
Protection	1
Sampling Frequency	10
Padding	1; when fs = 48
	0, matching
mode	10

Note: Padding bit 1 means Length Base frame = $\text{bitrate} / \text{fs} * 1152 \text{ (LII)} + 8 \text{ bits}$
0 means Length Base frame = $\text{bitrate} / \text{fs} * 1152 \text{ (LII)}$

5.1.1.2 CRC

	<>MPEG empowered
CRC	0 bit

note: depending on protection bit. In case of 0 bit the CRC

5.1.1.3 Side info

5.1.1.4 Audio

5.1.2 MPEG 2 Low Fs.

Encoding syntax is equal to MPEG 1.

5.1.3 MPEG 2

5.1.3.1 MC-header

	<>MPEG empowered
ML_fs	0 or 1
ML Layer	0 or 1
Ext.Stream present	0 true, no extension
	1 with extension.
	Base frame - (Ancillary data + 16 (+8)) bits MC-header < 0

5.1.3.2 CRC

5.1.3.3 MC Composite Status info

	<>MPEG empowered
MC_Pred_on	1

5.1.3.4 Side info

5.1.3.5 Audio

5.1.3.6 Multi Lingual

Multi Lingual is not supported within MPEG][I[empowered. No bits should be inserted, and may be tested by toggling the bits in the MC-header.

5.1.3.7 Extension

	MPEG empowered
Ext. Length	1584 .. 2047

5.1.4 7 channel Augmentation

6. MPEG STREAMS

The test bit streams, which are publicly available are summaries in a document, called 'results of Audio Conformance Test Using Technical Report Software' [MPEG_test]. The bit streams are accessible at the ftp-server of the university of Hanover. A number of these streams do also comply with the requirements of MPEG Multi Channel.

The ftp address of this site is: "ftp://ftp.tnt.uni-hanover.de/" The directory is "pub/MPEG/audio/...".

The streams specified in this clause can be found in the directory 'MPEG2/conformance-tests'

Table 33 n1237 TABLE 1

FEATURE	BIT STREAM NUMBER									
	1	2	3	4	5	6	7	8	9	10
MPEG MC Compliant	Y			Y		Y	Y			
Layer	II	II	II	II	II	II	II	II	II	II
matrix	3	0	1	0	3	3	0	0	0	0
extension	N	N	N	N	N	N	Y	Y	N	Y
transmission ch alloc	-	Y	Y	Y	-	-	Y	Y	Y	Y
phantom Centre	N	N	N	Y	N	N	N	N	N	N
prediction	N	N	N	N	N	N	N	N	Y*	N
Dynamic Cross	N	N	N	N	N	N	N	Y	N	N
Sampling frequency	44.1	48	32	48	44.1	48	48	48	48	48
LFE	Y	N	N	N	N	N	N	N	N	N
Multi Lingual	N	N	N	N	N	N	N	N	N	7
Multi Lingual Fs										48
ancillary data	N	N	N	N	Y	N	N	N	N	N
bitrate BASE stream	384	384	320	256	256	384	384	256	384	384
bitrate ext. stream							128	256		MAX
configuration	3/2	3/2	3/1	3/0	2/1	2+2	3+2	3/2	3/2	3/2

The streams 2, 3, 5, 8 and 9 are streams, in which the protection (no CRC) is switched off. All other fields are compliant.

y* Prediction, but no delay

Table 34 n1237 TABLE 1

FEATURE	BIT STREAM NUMBER									
	11	12	13	14	15	16	17	18	19	20
MPEG MC Compliant	Y						Y	Y	Y	Y
Layer	II	II	II	II	II	II	II	II	II	II
matrix	2	0	0	3	3	3	1	0	0	0
extension	N	Y	Y	N	N	N	Y	N	N	Y
transmission ch alloc	Y	Y	Y				Y	Y	Y	Y
phantom Centre	N	N	Y	N	N	N	N	N	N	N
prediction	N	N	Y*	N	Y	Y	N	N	N	N
Dyn Cross	N	N	Y	N	N	N	N	Y	Y	Y
Sampling frequency	44.1	48	48	44.1	48	48	48	48	48	44.1
LFE	N	N	Y	N	N	N	Y	N	N	N
Multi Lingual	N	7	N	N	N	N	N	N	N	N
Multi Lingual Fs		24								
ancillary data	N	N	Y	Y	N	N	N	N	N	N
bitrate BASE stream	384	384	384	384	384	384	384	384	384	VBR
bitrate ext. stream		384	MAX				256			VBR
configuration	3/2	3/2	3/2	3/2	3/2	3/2	3/2	3/1	2/1	3/2

The streams 12, 13, 14 and 15 are streams, in which the protection (no CRC) is switched off. All other fields are compliant.

Table 35 n1237 TABLE 1

FEATURE	BIT STREAM NUMBER			
	21	22	23	35
MPEG MC Compliant	Y			
Layer	II	I	III	II
matrix	0	0	0	3
extension	Y	Y	Y	N
transmission ch alloc	Y	Y	N/A	
phantom Centre	N	N	Y	N
prediction	N	N	N	N
Dyn Cross	N	N	N/A	N
Sampling frequency	48	44.1	48	44.1
LFE	N	N	N	N
Multi Lingual	7	N	N	N
Multi Lingual Fs	48			
ancillary data	N	N	N	N
bitrate BASE stream	384	384	320	384
bitrate ext. stream	MAX	384	320	
configuration	3/2	3/2	3/2	3/2
de-matrixing	N/A	N/A	Y	N/A
segment list	N/A	N/A	Y	N/A
matrix attenuation	N/A	N/A	N	N/A
scfsi	N/A	N/A	N	N/A

The streams 35 is a stream, in which the protection (no CRC) is switched off. All other fields are compliant.

Note: bitstream 35 is intended for accuracy tests. Output represented with 24 bit resolution

Table 36 n1237 TABLE 1

FEATURE	BIT STREAM NUMBER									
	24	25	26	27	28	29	30	31	33	34
MPEG MC Compliant layer	II	II	II	II	II	II	II	II	I	II
sampling frequency	16	22.05	24	24	24	24	24	24	22.05	24
bitrate	96	96	96	16	96	160	96	96	128	160
mode	joint	joint	joint	joint	joint	joint	single	dual	joint	stereo
ancillary data	N	N	N	N	N	N	N	N	N	N

7. ILLEGAL STREAMS

The streams specified in this clause can be found in the directory 'MPEG1/illegal-streams'

7.1 MPEG 1 test cases

7.1.1 header

	Illegal	checking
Sync word	<> fff	
Layer	00, 01, 11	tables
bitrate index	0000, 1111	tables
Sampling Frequency	11	tables
Padding	test wrong length	
mode	fault 00 or 01 <-> 11	bit allocation
mode extension	test bit fault	bit allocation
emphasis	10	feedback to Host

Note: Padding bit1 means Length Base frame = $\text{bitrate} / \text{fs} * 1152 \text{ (LII)} + 8 \text{ bits}$
0 means Length Base frame = $\text{bitrate} / \text{fs} * 1152 \text{ (LII)}$

7.1.2 CRC

	Illegal	checking
CRC	false CRC	CRC check

note: depending on protection bit. In case of 0 bit the CRC

7.1.3 Side info

	Illegal	checking
allocation	sb > sblimit	bit allocation
scfsi	sb > sblimit	bit allocation
scalefactors	sb > sblimit	bit allocation
	value 63	table access

7.1.4 Audio

	Illegal	checking
Sample words	all '1's	concealment of wrong sample word

Table 37 MPEG 1 Illegal bitstreams

name	illegal MPEG Multi channel property
ILL1_bridx00	bitrate index '0000' (legal MPEG)
ILL1_bridx15	bitrate index '1111'
ILL1_emphasis1	50/15 us emphasis (legal MPEG)
ILL1_emphasis2	reserved emphasis code
ILL1_layer0	reserved layer code
ILL1_layer1	layer I (legal MPEG)
ILL1_layer3	layer III (legal MPEG)
ILL1_overalloc	bitalloc and scfsi result in a MPEG 1 over-allocation
ILL1_padding1	padding set where it shouldn't be set
ILL1_samples	reserved sample codes in MPEG 1 part
ILL1_scf63	scalefactor code 63 occurs in MPEG 1 part
ILL1_sfreq3	reserved sampling frequency code
ILL1_sync	error in MPEG 1 sync pattern
ILL1_wrongcrc	wrong MPEG 1 CRC code

7.2 MPEG 2 Low Fs.

Encoding syntax is equal to MPEG 1.

7.3 MPEG 2

MC header	Illegal not within Base	checking robustness + concealment
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7.3.1.1 MC-header

extension	Illegal 0 1	checking and extension no extension
Centre	10	not defined
nr_of_ML	001 .. 111	not used
Ext.Stream present	0 true, no extension 1 with extension.	
	Base frame - (Ancillary data + 16 (+8)) bits MC-header < 0	

7.3.1.2 CRC

CRC	Illegal false CRC	checking CRC check
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7.3.2 MC Composite Status info

	Illegal	checking
tc_sbgr_select	swap	bit allocation
Dyn_cross_on	swap	bit allocation
MC_Pred_on	swap	bit allocation
tc_allocation	mtx = 3 + tca <> 0	table access
tc_allocation[sbgr]	PC + 3/2; tca<> 0,3,4,5 PC + 3/1; tca<> 0,3,4 PC + 3/0; tca<> 0 1/0 (+2.0) + tca <> 0	table access
dyn_cross_LR	'1' + MPEG 1 single	robustness
dyn_cross_mode[sbgr]	conflicts	table access
dyn_2nd_stereo[sbgr]	<> 3+2 or 2 + 2	table access
mc_prediction[sbgr]	1	bit allocation
predsi[sbgr][px]	00 .. 11	bit allocation

7.3.3 Side info

	Illegal	checking
allocation	sb > sblimit	bit allocation
scfsi	sb > sblimit	bit allocation
delay-comp[sbgr][px]	insert '0's	bit allocation
pred_coeff[sbgr][px][pci]	insert '0's	bit allocation
scalefactors	sb > sblimit; value 63	bit allocation

7.3.4 Audio

	Illegal	checking
Sample words	all '1's	concealment of wrong sample word

7.3.5 Multi Lingual

Multi Lingual is not supported within MPEG empowered. No bits should be inserted, and may be tested by toggling the bits in the MC-header.

Table 38 MPEG 2 Illegal bitstreams

name	illegal MPEG Multi channel property
ILL2_center2	reserved centre code
ILL2_dual	Multi channel in combination with MPEG 1 dual channel mode
ILL2_dynx22	reserved dynx code for the 2/2 configuration
ILL2_dynx31	reserved dynx code for the 3/1 configuration
ILL2_dynx32	reserved dynx code for the 3/2 configuration
ILL2_ext_switching	extension stream switches on/off
ILL2_mono	Multi channel in combination with MPEG 1 mono mode
ILL2_multilingual	multilingual on (legal MPEG 2)
ILL2_overalloc1	MC header does not fit in the base frame
ILL2_overalloc2	MC data does not fit in the available space
ILL2_prediction	prediction on (legal MPEG 2)
ILL2_samples	reserved sample codes in MPEG 2 part
ILL2_scf63	scalefactor code 63 occurs in MPEG 2 part
ILL2_tca21	reserved tca code for the 2/1 configuration
ILL2_tca30	reserved tca code for the 3/0 configuration
ILL2_tca30_PC	reserved tca code for Phantom Centre in 3/0
ILL2_tca31_PC	reserved tca code for Phantom Centre in 3/1
ILL2_tca31_mtx0	reserved tca code for mtx is 0 in the 3/1 configuration
ILL2_tca31_mtx2	reserved tca code for mtx is 2 in the 3/1 configuration
ILL2_tca32_PC	reserved tca code for Phantom Centre in 3/2
ILL2_wrongcrc	wrong MPEG 2 CRC code

7.4 7 ch Augmentation

	Illegal	checking
aug_mtx_proc	11	bit allocation
aug_future_ext	1	bit allocation
sev_error_check	false	CRC check
allocation	sb > sblimit	bit allocation
scfsi	sb > sblimit	bit allocation
scalefactors	sb > sblimit	bit allocation
	value 63	table access
data		
Sample words	all '1's	concealment of wrong sample word

Table 39 MPEG 2 + 7 ch Aug Illegal bitstreams

name	illegal MPEG Multi channel property
ILL3_aug_future_ext1	reserved aug_future_ext code
ILL3_aug_mtx_proc2	reserved aug_mtx_proc code
ILL3_dynx7	reserved dynx7 code
ILL3_ml_aug	7.1-ch augmentation in combination with multilingual
ILL3_31_aug	7.1-ch augmentation in combination with 3/1 configuration
ILL3_mono	7.1-ch augmentation in combination with mono
ILL3_overalloc	7.1-ch augmentation data does not fit in the available space
ILL3_samples	reserved sample codes in 7.1-ch augmentation part
ILL3_scf63	scalefactor code 63 occurs in 7.1-ch augmentation part
ILL3_wrongcrc	wrong 7.1-ch augmentation CRC code

7.5 Extension

	Illegal	checking
Extension header	less than 5 bytes	bit allocation + robustness
Ext. Sync.	<> 0x7ff	bit allocation
Ext. CRC	wrong CRC	CRC check
Ext. ID	1	robustness

Table 40 MPEG 1 bitstreams with illegal extensions

name	illegal MPEG Multi channel property
ILL4_ext_id1	reserved ext_id code
ILL4_sync	error in extension sync pattern
ILL4_wrong_length1	extension length smaller than 5
ILL4_wrong_length2	extension length does not match with extension frame length
ILL4_wrongcrc	wrong extension CRC code

8. IEC61937

The test-bitstreams for testing IEC61937 are divided in test, the test the synchronisation on the preamble. The tests in sub-clause 8.1 contain stream in which Pa and/or Pb is wrong. Sub-clause 8.2 contains tests, with variations of preamble bits. Sub-clause 8.3 contains bitstreams with data-type 5, with gaps but without Pause bursts.

8.1 Preamble tests

Ppre indicates streams to test errors in the synchronisation with Pa and Pb. The file names Pre03 contain these errors in Pause bursts, Pre05 contains these errors in bursts with an MPEG payload, without extension.

Paa indicates that Pa is, by 'mistake' followed by a second Pa (instead of Pb)

Pba indicates that the order of Pa and Pb are swapped.

Pbb indicates that, by 'mistake', Pa was replaced by a Pb.

Table 41 test-bitstreams to test Preamble errors

	data-type	error	data-type dept.	bitstream number	Number of Pause bursts
Ppre03Paa	5	0	0	0	1
Ppre03Pba	5	0	0	0	1
Ppre03Pbb	5	0	0	0	1
Ppre05Paa	5	0	0	0	0
Ppre05Pba	5	0	0	0	0
Ppre05Pbb	5	0	0	0	0

8.2 Test Preambles

IEC61937 test-bitstreams are stored in the /testsuit/IEC61937/test directory. The naming convention is : Pc0123456

P Stand for streams in the directory

c c is IEC61937 compliant

n contains a payload without extension

e contains a payload with extension

p stands for testing gaps by varying the number of Pause burst

m stand for a stream in which a longer repetition period occurs

l stand for a stream in which a shorter repetition period occurs

01 is the data-type

2 stands for bits 5, 6 (always 0) and 7

34 stands for the data-type-dependent info

5 stands for the bitstream number

6 in case of Pm or Pl, the deviation in repetition period in sampling periods.
Or in case of Pp the number of Pause bursts.

Table 42 test-bitstreams with mismatching pay_load

	data-type	error	data-type dept.	bitstream number	repetition period
Pe050000	5	0	0	0	1152
Pn060000	6	0	0	0	1152

Table 43 test-bitstreams with matching pay_load

	data-type	error	data-type dept.	bitstream number	repetition period
Pe060000	6	0	0	0	1152
Pn050000	5	0	0	0	1152

Table 44 test-bitstreams to test different data-types

	data-type	error	data-type dept.	bitstream number	repetition period
Pn000000	0	0	0	0	1152
Pn010000	1	0	0	0	1152
Pn020000	2	0	0	0	1152
Pn030000	3	0	0	0	1152
Pn040000	4	0	0	0	1152
Pn070000	7	0	0	0	1152
Pn080000	8	0	0	0	1152
Pn090000	9	0	0	0	1152
Pn100000	10	0	0	0	1152
Pn110000	11	0	0	0	1152
Pn120000	12	0	0	0	1152
Pn130000	13	0	0	0	1152
Pn140000	14	0	0	0	1152
Pn150000	15	0	0	0	1152
Pn160000	16	0	0	0	1152
Pn170000	17	0	0	0	1152
Pn180000	18	0	0	0	1152
Pn190000	19	0	0	0	1152
Pn200000	20	0	0	0	1152
Pn210000	21	0	0	0	1152
Pn220000	22	0	0	0	1152
Pn230000	23	0	0	0	1152
Pn240000	24	0	0	0	1152
Pn250000	25	0	0	0	1152
Pn260000	26	0	0	0	1152
Pn270000	27	0	0	0	1152
Pn280000	28	0	0	0	1152
Pn290000	29	0	0	0	1152
Pn300000	30	0	0	0	1152
Pn310000	31	0	0	0	1152

Note that the streams specified in Table 44 do also contain 3 Pause bursts.

Table 45 test-bitstreams for Pc bits 7, 12 and 13..15

	data-type	error	data-type dept.	bitstream number	repetition period
Pc050010	5	0	0	1	
Pc050020	5	0	0	2	1152
Pc050030	5	0	0	3	1152
Pc050040	5	0	0	4	1152
Pc050050	5	0	0	5	1152
Pc050060	5	0	0	6	1152
Pc050070	5	0	0	7	1152
Pc050100	5	0	1	0	1152
Pc051000	5	1	0	0	1152

Table 46 test-bitstreams with deviating repetition period

	data-type	error	data-type dept.	bitstream number	repetition period
PI050001	5	0	0	0	1151
PI050002	5	0	0	0	1150
PI050004	5	0	0	0	1148
PI05000A	5	0	0	0	1142
Pm050001	5	0	0	0	1153
Pm050002	5	0	0	0	1154
Pm050004	5	0	0	0	1156
Pm05000A	5	0	0	0	1162

Table 47 test-bitstreams to test Gaps between bursts in number of Pause bursts

	data-type	error	data-type dept.	bitstream number	Number of Pause bursts
Pp0500p1	5	0	0	0	1
Pp0500p2	5	0	0	0	2
Pp0500p3	5	0	0	0	3
Pp0500p4	5	0	0	0	4
Pp0500p5	5	0	0	0	5
Pp0500p6	5	0	0	0	6

8.3 Testing gaps

IEC61937 test-bitstreams are stored in the /bitstreams/IEC61937/test directory. The naming convention is : Pr01234567

P Stand for streams in the directory

r stands for testing deviations of the repetition period.

01 is the data-type is 05, MPEG 2 without extension

2 stands for bits 5, 6 (always 0) and 7

34 stands for the data-type-dependent info

5 stands for the bitstream number

67 The length of the gap between bursts.

Table 48 test-bitstreams to test re-sync after Gaps

	data-type	error	data-type dept.	bitstream number	Length gap	of
Pr0500003	5	0	0	0	3	
Pr0500004	5	0	0	0	4	
Pr050000A	5	0	0	0	10	
Pr0500010	5	0	0	0	16	
Pr0500018	5	0	0	0	24	
Pr050001C	5	0	0	0	28	
Pr050001E	5	0	0	0	30	
Pr050001F	5	0	0	0	31	
Pr0500021	5	0	0	0	33	
Pr0500024	5	0	0	0	36	
Pr0500030	5	0	0	0	48	
Pr050003F	5	0	0	0	63	
Pr050005F	5	0	0	0	95	
Pr0500060	5	0	0	0	96	
Pr0500080	5	0	0	0	128	
Pr0500090	5	0	0	0	144	
Pr05000C0	5	0	0	0	192	